

PLANT ITEM MATERIAL SELECTION DATA SHEET

HOP-ADBR-00001A/B & 2A/B (HLW)

Activated Carbon Adsorber

- Design Temperature (°F): 275
- Design Pressure (in-WG): -82
- Location: outcell

ISSUED BY
RPP-WTP PDC

R10378685

Contents of this document are Dangerous Waste Permit affecting

Operating conditions are as stated on sheets 4 and 5

Options Considered:

- Equipment is maintainable.
- A preheater will be used to prevent condensation from forming in the activated carbon media during start-up or after replacement.

Materials Considered:

Material (UNS No.)	Relative Cost	Acceptable Material	Unacceptable Material
Carbon Steel	0.23		X
304L (S30403)	1.00		X
316L (S31603)	1.18	X	
6% Mo (N08367/N08926)	7.64	X	
Alloy 22 (N06022)	11.4	X	
Ti-2 (R50400)	10.1		X

Recommended Material: 316 (max 0.030% C; dual certified)

Recommended Corrosion Allowance: NA

Process & Operations Limitations:

- None

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This bound document contains a total of 5 sheets.

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PLANT ITEM MATERIAL SELECTION DATA SHEET**Corrosion Considerations:**

The sulfur-impregnated activated carbon column removes volatile mercury compounds from the offgas at a mildly elevated temperature, 186 to 275 °F. During normal operation air atomized demineralized water is injected into the inlet piping to cool the offgas to operating temperature. The offgas humidity is maintained below 50 % relative such that the water does not condense in the column.

a General Corrosion

The anticipated dry-air conditions are not conducive to general corrosion and none is expected.

Conclusion

Either 304L or 316L would be satisfactory.

b Pitting Corrosion

Pitting corrosion will only be a concern if moisture is present. It is assumed that there will be no condensation in the unit. For safety, 316L is recommended.

Conclusion

At the stated operating conditions, pitting corrosion is not a significant concern. Recommend 316L.

c End Grain Corrosion

End grain corrosion only occurs in high acid conditions and is not a concern.

Conclusion:

Not a concern

d Stress Corrosion Cracking

At operations at the stated temperatures, stress corrosion cracking will only be a concern in the presence of moisture. It is assumed that there will be no condensation in the unit. Also see Pitting.

Conclusion

At the stated operating conditions, stress corrosion cracking is not a concern.

e Crevice Corrosion

Crevice corrosion will only be a concern if moisture is present. The offgas humidity is controlled so that there will be no condensation.

Conclusion

At the stated operating conditions, crevice corrosion is not a concern.

f Corrosion at Welds

Assuming dry air and proper welding procedures, corrosion at welds is not anticipated.

Conclusion

At the stated operating conditions, weld corrosion is not a concern.

g Microbiologically Induced Corrosion (MIC)

The stated operating conditions are not suitable for microbial growth.

Conclusion

At the stated operating conditions, MIC is not a concern.

h Fatigue/Corrosion Fatigue

Extreme temperature cycling or fluctuations are not expected.

Conclusion

At the expected operating conditions, corrosion fatigue is not a concern.

PLANT ITEM MATERIAL SELECTION DATA SHEET**i Vapor Phase Corrosion**

Components essential consist entirely of vapor space so general corrosion comments apply.

Conclusion:

See comments under general corrosion.

j Erosion

The velocity and solids content are sufficiently low that erosion is not a concern.

Conclusion

Erosion is not a concern.

k Galling of Moving Surfaces

There are no unlubricated moving surfaces present.

Conclusion:

Galling is not a concern.

l Fretting/Wear

No metal/metal contacting surfaces are expected.

Conclusion:

Fretting is not a concern.

m Galvanic Corrosion

No significantly dissimilar metals are present nor is moisture assumed to be present.

Conclusion:

Galvanic corrosion is not a concern.

n Cavitation

Cavitation is not expected in an off-gas system

Conclusion:

Cavitation is not a concern.

o Creep

Stated operating temperatures are too low for creep to occur.

Conclusion

Creep is not a concern.

p. Inadvertent Addition of Nitric Acid

Addition of nitric acid to the offgas lines is not a plausible scenario.

Conclusion

Not applicable

PLANT ITEM MATERIAL SELECTION DATA SHEET

OPERATING CONDITIONS

PROCESS CORROSION DATA SHEET

Component(s) (Name/ID #) Activated carbon adsorber
(HOP-ADBR-00001A/B, HOP-ADBR-00002A/B)

Facility HLW

In Black Cell? No

Chemicals	Unit ¹	Contract Maximum		Non-Routine		Notes
		Leach	No leach	Leach	No Leach	
Aluminum	g/m ³					
HCl	g/m ³					
HF	g/m ³		1.08E-04			
Iron	g/m ³					
NO	g/m ³	6.28E-01	6.52E-01			
NO2	g/m ³	1.71E-01	1.84E-01			
Phosphate	g/m ³					
SO2	g/m ³					
Mercury	g/m ³	2.50E-03	3.95E-03			
Carbonate	g/m ³					
Undissolved solids	wt %					
Other (NaMnO4, Pb,...)	g/m ³					
Other	g/m ³					
Humidity	%	41%	41%			
Temperature	°F					Note 2
List of Organic Species:						
Notes: 1. Concentrations less than 1×10^{-4} g/m ³ do not need to be reported; list values to two significant digits max. 2. Tmin 186 °F, Tmax 250 °F.						
Assumptions						

PLANT ITEM MATERIAL SELECTION DATA SHEET**5.4.2 Activated Carbon Adsorber (HOP-ADBR-00001A/B, HOP-ADBR-00002A/B)****Routine Operations**

The sulfur-impregnated activated carbon (AC) column removes volatile mercury compounds from the offgas at a mildly elevated temperature. The AC column consists of two sulfur-impregnated activated charcoal beds. Each bed is contained inside a vessel that is insulated. The piping and valving are arranged to operate the beds in series (normal), in parallel, or individually. Connections are provided on each vessel to load the AC through isolation valves from multiple lines using a manual gravity feed chute supplied from a feed hopper located above the vessel(s). Spent AC is removed from a bed by gravity draining through multiple line isolation valves and using a screw conveyor system to route the AC to a vessel for packaging. The second bed can continue operation during bed changeout. There is a system bypass line that can be manually activated. During normal operation air atomized demineralized water is injected into the inlet piping to cool the offgas to operating temperature. An automatically activated water deluge fire suppression system is provided for safety. The system is activated based on differential inlet to exit CO concentration. The offgas inlet isolation valve is automatically closed on system activation. A water overflow valve is automatically activated in each vessel in case of fire to prevent overfilling with water. A water drain system is also provided.

This equipment is operated at low humidity.

Non-Routine Operations that Could Affect Corrosion/Erosion

None identified.